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# METHOD AND DEVICE FOR ATTENUATING THE MOTION OF HYDRAULIC CYLINDERS OF MOBILE WORK MACHINERY

## CLAIMS

1. A method for attenuating the motion of hydraulic cylinders (10, 11) of mobile work machinery, in particular of hydraulic excavators, in which prior to reaching one of the limits of travel of the hydraulic cylinder (10, 11) its motion speed is reduced, and the hydraulic cylinder (10, 11) is moved to the respective limit of travel at reduced speed; wherein for the purpose of reducing the speed, the inflow to, and/or the outflow from, the hydraulic cylinder (10, 11) are/is throttled by means of a flow control device (4, 5, 6), characterised in that prior to the respective limit of travel being reached, the motion speed of the hydraulic cylinder (10, 11) is registered, and the point in time (P7, P7') when throttling commences is changed depending on the registered motion speed.

2. The method according to the previous claim, wherein the throttling speed of the flow control device (4, 5, 6) is preset irrespective of the registered motion speed of the hydraulic cylinder (10, 11).

3. The method according to one of the preceding claims, wherein commencement of attenuation (P7, P7')is delayed with reduced registered motion speed.

4. The method according to any one of the preceding claims, wherein a fixed initial point in time (P7) is always preset if the registered motion speed is greater than, or equal to, a preset limit speed, and wherein, if the motion speed registered is below the limit speed, the point in time (P7') is delayed in relation to the fixed point in time (P7) by a period of time ($t_F$).

5. The method according to the preceding claim, wherein the period of time ($t_F$) is changed depending on the registered motion speed, preferably selected proportionally in relation to the registered motion speed.

6. The method according to any one of the preceding claims, wherein prior to reaching the respective limits of travel, two limit signal transmitters ($S_1$, $S_2$) which are arranged in tandem, are overtravelled; the period of time ($t_K$) between overtravel of the two limit signal transmitters ($S_1$, $S_2$) is registered; from the registered period of time ($t_K$) and a preset period of time ($t_S$) a time difference (□t) is determined; and according to the time difference (□t), a delay ($t_F$) of the point in time (P7') when attenuation commences is determined.

7. A device for attenuating the motion of hydraulic cylinders of mobile work machinery, in particular of hydraulic excavators, according to the method according to any one the preceding claims, comprising a position registering device (17) for registering a preliminary limit position of the hydraulic cylinder (10, 11), a control device (4, 5, 6) for throttling the inflow and/or outflow of the hydraulic cylinder (10, 11) and a control device (15) for controlling the flow control device (4, 5, 6) when the preliminary limit position is reached, characterised in that it comprises a speed registering device (16) for registering the motion speed of the hydraulic cylinder when the preliminary limit position is reached, and in that the control device (15) comprises a delay device for delaying driving the flow control device (4, 5, 6), depending on the registered motion speed.

8. The device according to the preceding claim, wherein the speed registering device (16) comprises two limit signal transmitters ($S_1$, $S_2$) arranged in tandem, and a time registering device (19) is provided which registers the period of time ($t_K$) between the signals of the two limit signal transmitters ($S_1$ and $S_2$).

9. The device according to the preceding claim, wherein one of the limit signal transmitters ($S_1$, $S_2$) at the same time forms the position registering device (17).

10. The device according to one of the preceding claims, wherein first and second markings (21, 22) are provided at the piston rod (18) of the hydraulic cylinder (10, 11) and/or at a detection transmitter 20 coupled therewith, with said first and second markings (21, 22) corresponding to

the two preliminary limit positions, and with both markings being able to be registered by the position registering device (17) and/or the speed registering device (16).

11. The device according to any one of the preceding claims, wherein the speed registering device (16) is integrated in the hydraulic cylinder (10, 11).

12. The device according to any one of the preceding claims, wherein the speed registering device (16) is arranged so as to be separate from the hydraulic cylinder (10, 11) and is associated with a detection transmitter (20).

13. The device according to any one of the preceding claims, wherein the control device (15) comprises a comparator device (23) for comparing the registered period of time ($t_K$) with a preset period of time ($t_S$) and for forming the difference between the two periods of time ($t_K$, $t_S$), and wherein the delay device comprises a delay transmitter which presets the delay ($t_F$) at which the flow control device (4, 5, 6) is driven, with such presetting depending on the determined difference, preferably being proportional to said difference.

14. The device according to any one of the preceding claims, wherein the position registering device (17) is associated with a hinge point of two components of the motion train which is driven by the hydraulic cylinder (10, 11), with said position registering device (17) registering the position of the two components in relation to each other.